

## Asset Liability Management

# Challenges Pension Funds Face due to Low Interest Rates

**28<sup>th</sup> After-Work Lecture on Asset & Investment Management**

**PPCmetrics AG**

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Vaduz, 26<sup>th</sup> March 2015

# Interest Rate Risk...

...also worried pension funds a few years ago

*“Jetzt, wo ein beträchtlicher Theil der zum Vermögen der Witwenkasse gehörenden Staatspapiere so sehr tief unter dem Nennwerthe steht, halte ich für nothwendig, in der Bilanzrechnung die Papiere nach dem zeitigen wirklichen Werthe, wie sie sich realisiren lassen, zu evaluiren.”\**

**We should evaluate bonds  
on a mark-to-market basis.**

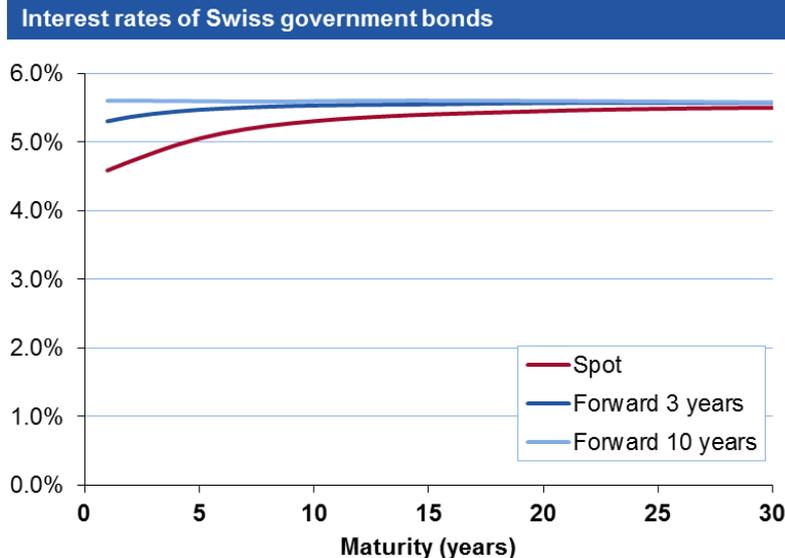
Carl Friedrich Gauss  
(1777 - 1855)

\* **Gauss, C. F. (1851):** Anwendung der Wahrscheinlichkeitsrechnung auf die Bestimmung der Bilanz für Witwenkassen.  
in: Gauss, C. F.: Werke, Band 04. Wahrscheinlichkeitsrechnung und Geometrie, Göttingen, 1873.

# Market Dynamics (1)

## Imagine...

- Risk-free interest rates above 5%
- Inflation for next 5 - 10 years around 1% - 2%
- Mandatory benefits based on interest rate of 4%



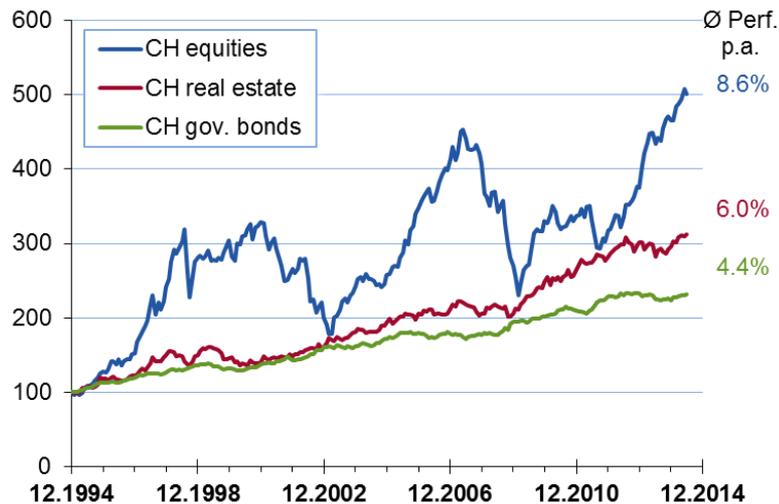
## Tempting thoughts:

- Financing of benefits secured for next 20 years.
- Duration of bond portfolio does not really matter.

**Situation**  
**31.12.1994**

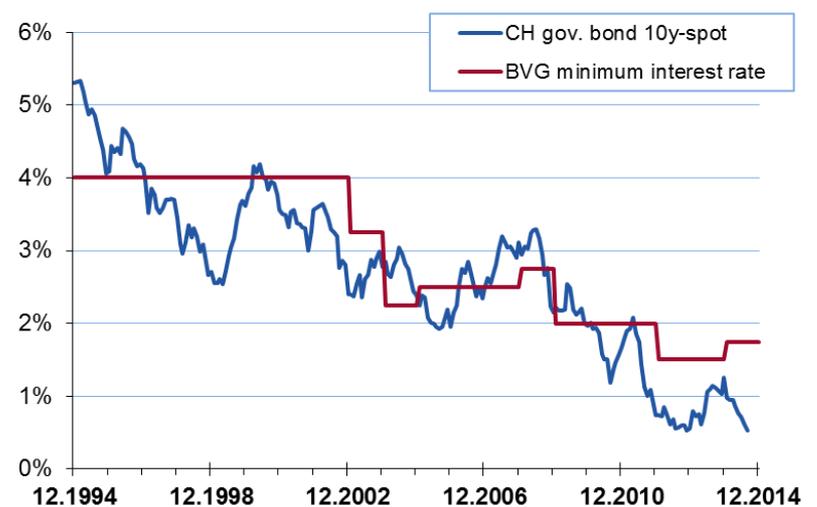
## How things went:

Indexed returns



Even if things go well overall, management of risk is essential.

Evolution of interest rates

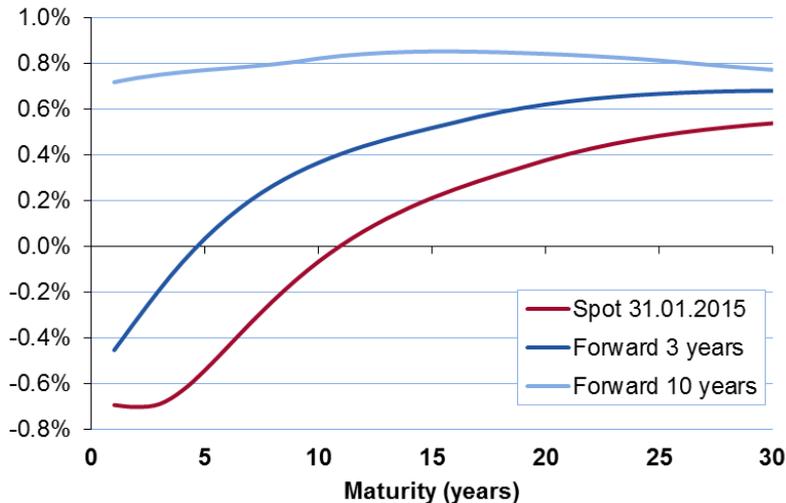


Level of interest rates is crucial but hardly predictable. Its (dynamic) impacts on assets and liabilities should be considered for ALM.

## Current situation:

- Risk-free interest rates at 0%
- BVG minimum interest rate 1.75%
- Conversion rate of 6% in 2020 implies interest rate of ~3.5%

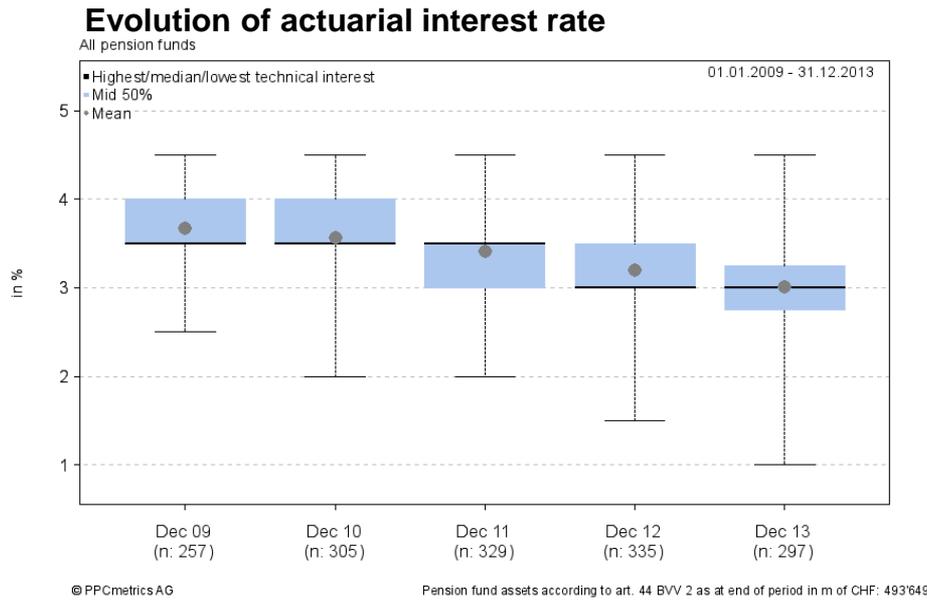
Interest rates of Swiss government bonds



## Frequent questions:

- Wait for better times?
- Compulsion to asset-risk?
- Active/smart management of asset risk as an issue?

# Required Rate of Return...



- Benefits to pensioners are nominally guaranteed and discounted with a fixed actuarial interest rate.
- However, required rate of return lower as less is credited to savings accounts of active members.
- Usually, required return is between 2% and 3% (while 4% can also be seen).

# Basics on Expected Return

## Breakdown of expected return



- Expected return is composed of:
  - Return of risk-free investments (**“market interest rate”**)  
Market data available → quantifiable value
  - Additional return on risky investments (**“risk premium”**)  
No market data available → value is always unknown
  - Exposure to risk factor (**“investment strategy”**)

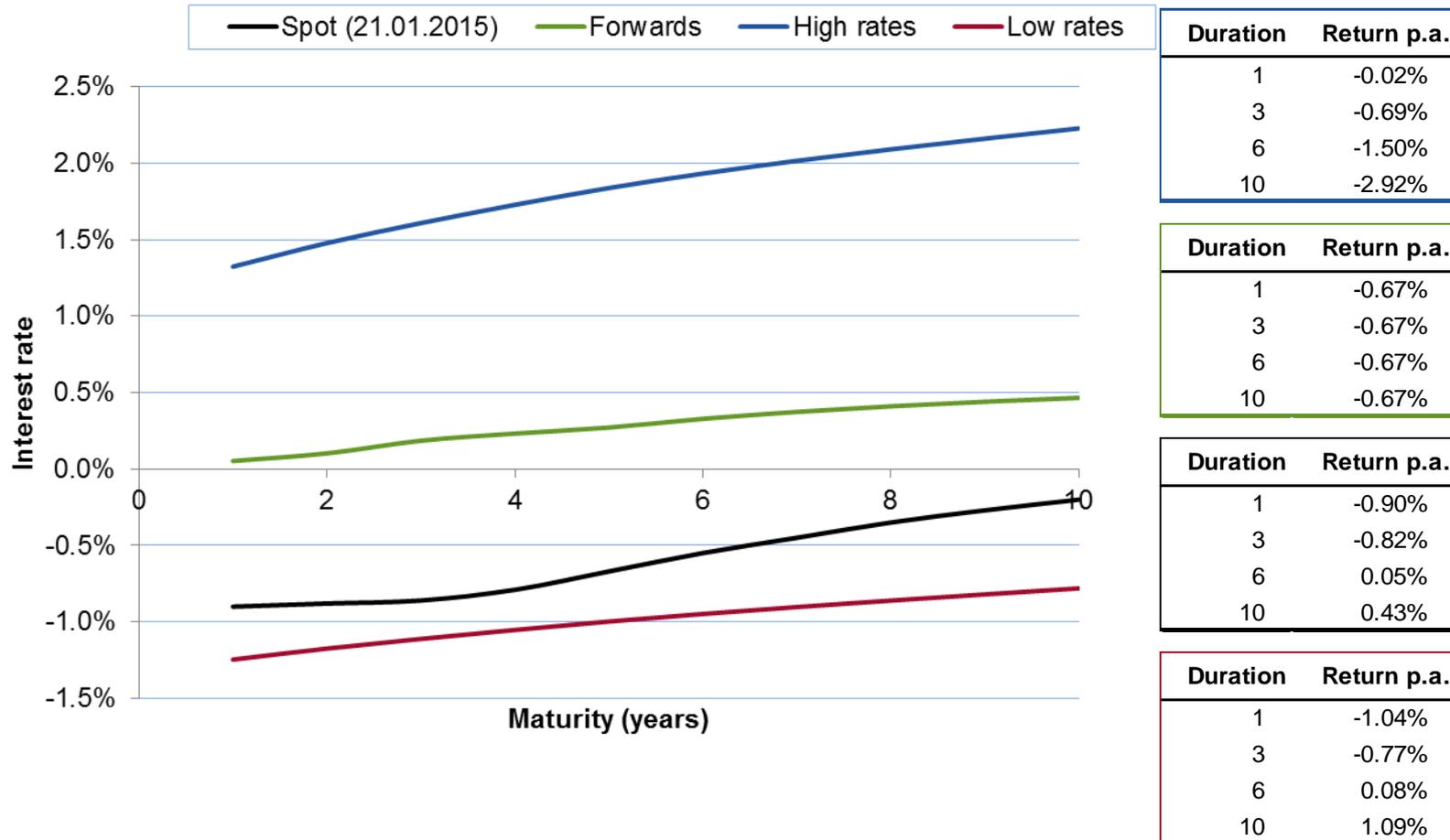
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$$\text{Expected return} = \text{Risk-free interest rate} + \text{Risk premium} \times \text{Exposure}$$

# Record Low Market Interest Rates

## Interest rate scenarios and possible returns

Actual interest rates and today's expected interest rates in 5 years



Returns p.a. over 5 years

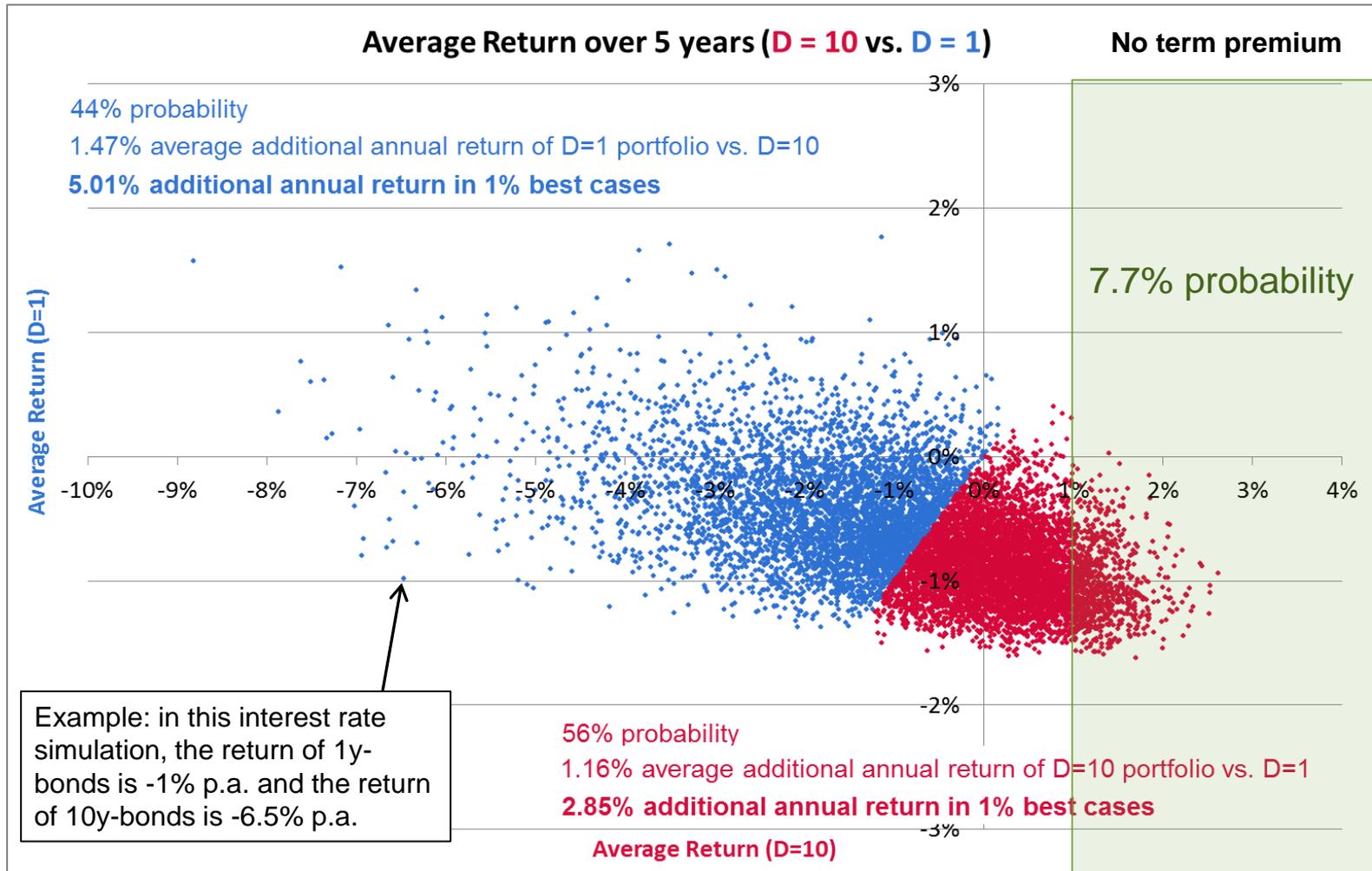
# Interest Rate Simulations

## Interpretation of subsequent chart

- Results of interest rate simulations (10'000 runs) are depicted **two-dimensionally**:
  - **X-axis**: realized return for bond portfolio with **long** duration (10y)
  - **Y-axis**: realized return for bond portfolio with **short** duration (1y)
- Portfolios are assumed to be «rolling», i.e. at the end of every year, the duration is reset to the initial value
- Assumption: **no term premium**
- Return corresponds to average annual return over 5 years
- **Red dots**:
  - Return of **longer** durations is higher
- **Blue dots**:
  - Return of **shorter** durations is higher

# Interest Rate Simulations

Duration 10 (x-axis) vs. Duration 1 (y-axis)



# Conclusion:

## Long vs. Short

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- Risk-averse asset-only investors should go for short duration as risk return is distributed highly asymmetrically.
- Pension funds are **not asset-only investors!**
- Usually, liabilities have a long duration; hence, **short duration bonds increase risk relative to liability.**
- If a term premium of  $>0\%$  is assumed (return of long duration is higher than short duration), then pensions funds should go for long duration, as risk is lower and expected return is higher.
- If a term premium of  $<0\%$  is assumed, one can argue to go for short duration and increase risk in order to harvest risk premia.

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$$\text{Expected return} = \text{Risk-free interest rate} + \text{Risk premium} \times \text{Exposure}$$

# Risk Premium

Is every risk rewarded?

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- **Size of risk premium** is **always unknown** ex ante.
- **Methods of estimation**
  - Analysis of historical values
  - Survey of experts (portfolio managers, CFOs etc.)
  - Calculation based on a model
- **Not every risk** is rewarded with a **premium**
  - Concentration risk
  - Implementation risk
  - ...

# Risk Premium

Which equity risk premium can be expected?

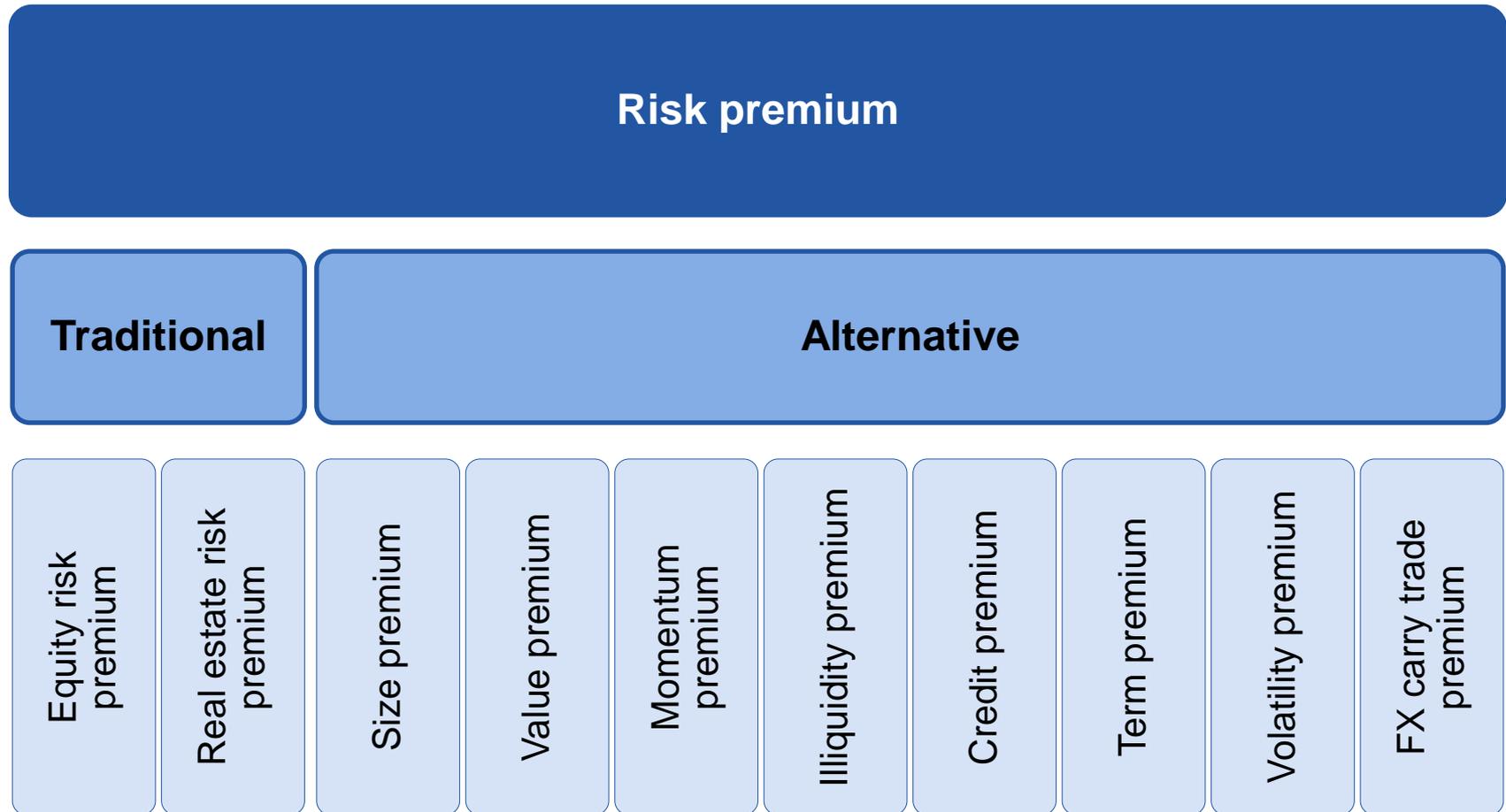
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- For pension funds, the **equity risk premium** is the most relevant.
- Empirical results since 1900\*:
  - **Global equity 3.2% p.a.** (US: 4.4%, CH: 2.1%)
  - Periods of 20 years with negative real returns on global equity (over 50 years for Germany, France and Japan)
  - Breakdown of individual markets (Russia, China)
- Pension funds also seek **real estate risk premium**. Additional risk premiums **are being sought after!**

\* **Dimson, E. et al (2015):** in Credit Suisse Global Investment Returns Yearbook, London Business School.  
**Dimson, E. et al (2006):** The Worldwide Equity Premium: A Smaller Puzzle, London Business School.

# Risk Premium

## Types of risk premiums



Based on **Ang, A. et al. (2009)**: Evaluation of Active Management of the Norwegian GPF, Norway: Ministry of Finance.

# Risk Premium

## Breakdown of asset classes into risk premiums

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- **Asset classes** cannot always be distinctively **allocated to only one risk premium.**
- **Example: Senior Secured Loans**  
(Non-listed credits to non-investment-grade entities)
  - Illiquidity
  - Credit
  - Potentially: Volatility
- Possible **overlaps** with existing investment risks should always be checked for.

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$$\text{Expected return} = \text{Risk-free interest rate} + \text{Risk premium} \times \text{Exposure}$$

- Pension funds cannot boundlessly invest in **risky asset classes**:
  - Financial and structural risk capacity is crucial.
  - Bonds are and will always be an important investment class.
- **Risk budgets are always tight!**
- Goal of portfolio optimization:
  - Find efficient combination of risk and expected risk premiums.
  - **Efficient allocation of tight risk budget.**

# Investment Strategy

## Important factors for portfolio optimization

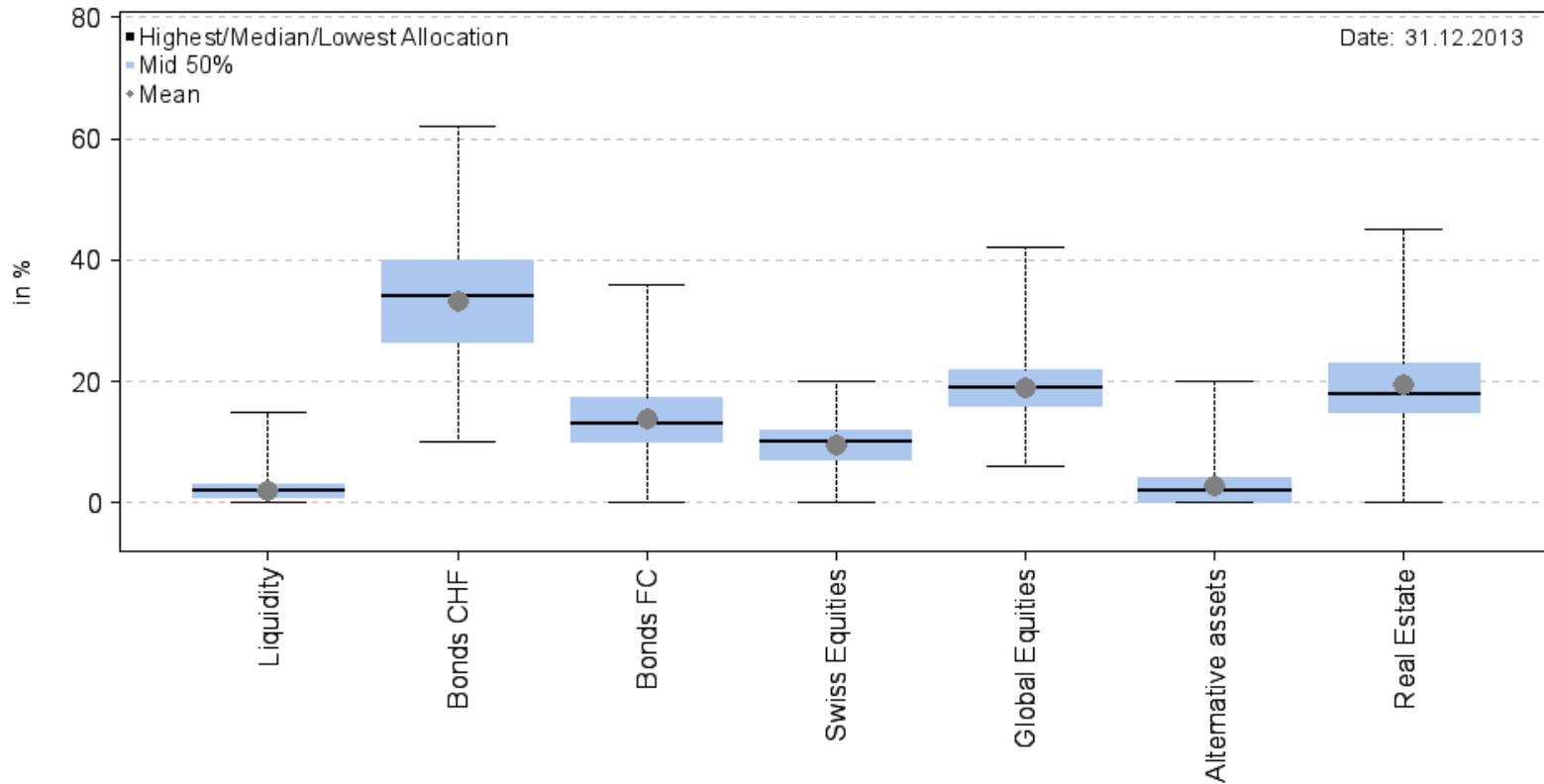
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- Before incorporating any new risk factor into an investment strategy, the following questions should be analyzed:
  - **Extent of risk** (relative to liabilities)?
  - **Expected premium?**
  - **Overlaps with existing portfolio?**
  - **Effort for acquisition?**
  - **Reallocating cost?**
- An optimized strategy depends on (amongst others)
  - Liabilities
  - **Size of assets**
  - Available (human) resources

# Investment Strategy

## How are Swiss pension funds invested?

### Strategy - Overview



Expected return

=

Risk-free  
interest rate

+

Risk premium

x

Exposure

# Expected Return

Low interest rates limit expected returns

- PPCmetrics uses an **own model for estimation:**
  - **Investment strategy and expected return of an “average Swiss pension fund”**
    - 45% bonds
    - 30% equity
    - 20% real estate
    - 5% alternative investments
- $E(R) \approx 1.75\%$  to  $2.25\%$**



# Expected Return

What to do in case of structural funding deficits?

*“Als wirklich kräftige Mittel können demnach nur betrachtet werden:*

- 1) Erhöhung der Beiträge.*
- 2) Herabsetzung der Pensionen.*
- 3) Verbindung beider Mittel.”\**

**Effective measures are**

- 1) Increase of contributions**
- 2) Reduction of benefits**
- 3) Any combination of these two**

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